



# NMCI ISF

# Facilities Standards

# DRAFT

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## Overview

### Purpose:

This **NMCI ISF Facilities Standards** document is intended to be used as a template, or guide, for the design and construction of a NMCI server farm facility. It is *general* in nature but it defines the ***Commercial Standards*** that will be applied to the design of a *new* facility. It should not be construed to be the final contract document specification.

In addition to being a template for a *new* facility, it may also be used as a guideline in evaluating *existing* facilities.

## **01      SECTION A      SITE BASELINES**

Following are brief baselines that must be taken into consideration when providing the NMCI site services teams with GFF candidates. These guidelines are written in order of selection criteria, so that a GFF site can quickly be validated for review by the ISF Facilities Teams:

### **01.1      Square Footage Baselines**

Server Farm Size	Raised Floor sf	Raised Floor psf	Utility Room sf	Utility Room psf
Small – 1,850 sf	1329	150	521	450
Medium – 3,000 sf	2279	150	721	450
Large – 4,850 sf	3758	150	1092	450
Very Large – 7,250 sf	5891	150	1359	450

01.1.1 Server farms require contiguous, functionally usable space.

01.1.1.1 Small (s)- 1,850 s.f;

01.1.1.2 Medium (m)-3,000 s.f;

01.1.1.3 Large (l)- 4,850 s.f;

01.1.1.4 Very large (vl)- 7,250 s.f.;

### **01.2      Floor Loading Baselines**

01.2.1 There are two scenarios that will immediately validate or deny a GFF for consideration by the ISF team. A) Is the GFF on grade and capable of supporting 450 pounds per square foot of load or, B) If it is not, can space support 150 pounds per square foot of raised floor space AND additional space be made available on interior grade for the Uninterruptible Power Supplies and batteries supporting the Server Farm. Because of the large amount of equipment being placed in these Server Farms, and the extreme weight of the Uninterruptible Power Supplies and their batteries, the following criteria must be met to ensure a candidate building can be offered to the ISF as a viable site:

01.2.1.1 Floor loading capacities for the raised floor area of the server farm must be able to support 150 lbs per square foot.

01.2.1.2 Floor loading capacities for the mechanical, electrical and battery rooms must be able to support 450 lbs per square foot.

01.2.2 Typical breakdown of Server Farm and Uninterruptible Power Supply / Battery square footages:

### **01.3      Base Level Support Baselines**

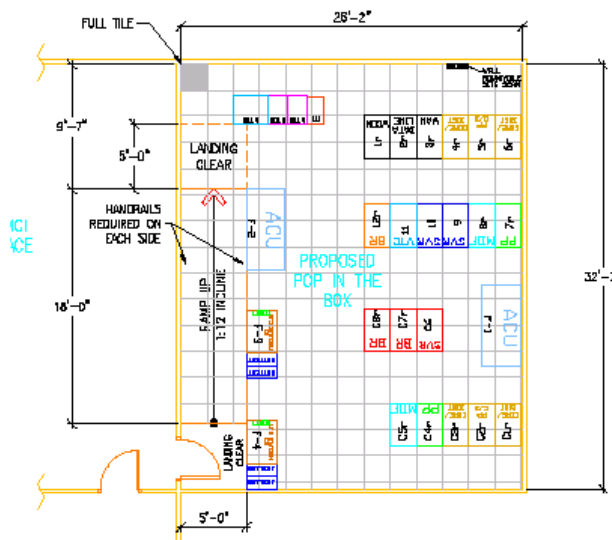
01.3.1 Support for the ISF Contractor during NMCI implementation and ongoing operations will require both permanent and temporary space for administration and warehousing. The ideal space would be near the server farm to facilitate construction and operations, as well as minimize disruption to base operations.

Server Farm Size	Perm Admin space	Temp Admin space	Perm W/house space	Temp W/house
Small – 1,850 s.f	700 sf	400 sf	1,600 sf	2,000 sf
Medium – 3,000 s.f.	1,100 sf	1,300 sf	1,700 sf	2,500 sf
Large – 4,850 s.f.	2,200 sf	1,800 sf	3,000 sf	3,000 sf
Very Large – 7,250 s.f.	3,000 sf	2,500 sf	3,600 sf	5,000 sf

## 01.4 Point of Presence (POP) Level Support Baselines

01.4.1 The ISF Site Point of Presence (POP), including the Information Assurance (IA) boundary, WAN, Core and Distribution Switching will require permanent space for the support of its infrastructure and equipment. The ideal space will be near the site's existing main point of entry (MPOE) for telecommunications infrastructure.

Site Size in Seats	SF-Unclassified	SF-Classified	Racks-Unclassified	Racks-Classified
Up to 48	60sf	60sf	1	1
49 – 100	80sf	80sf	2	2
101-200	200sf	200sf	5	5
201 – 1000	280sf	280sf	7	7
1000 +	360sf	360sf	9+	9+

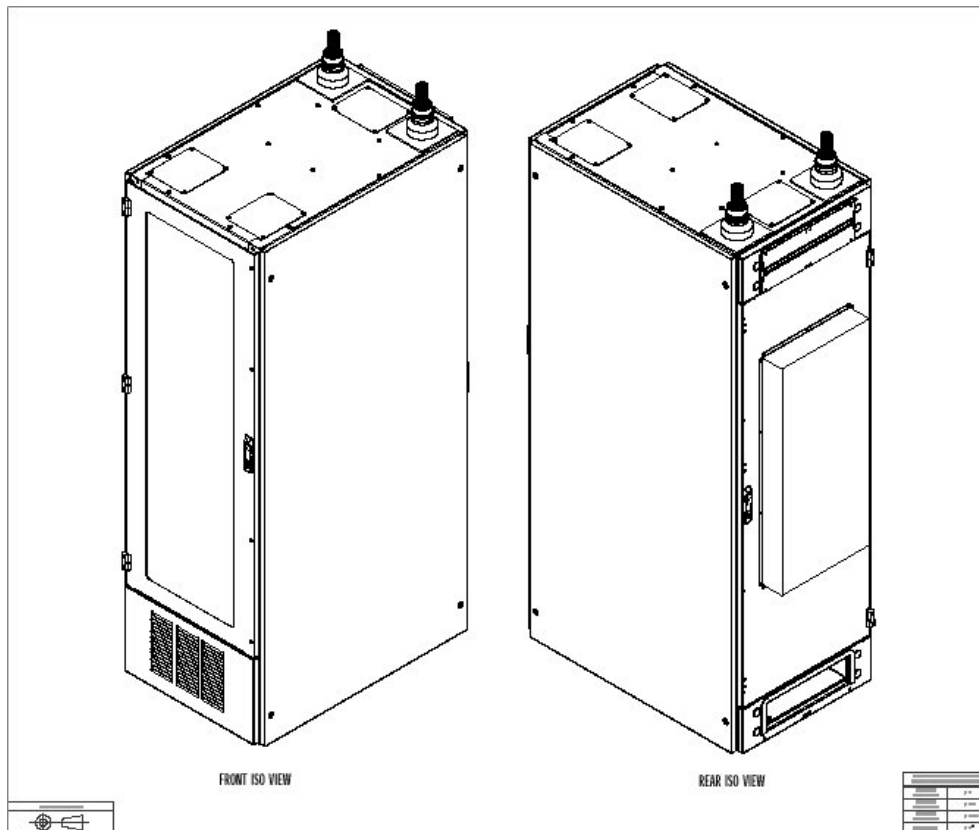


## 01.5 Intermediate and Main Distribution Frame (IDF & MDF) Level Support Baselines

10.1.5.1 The ISF Access (IDF) and Distribution (MDF) level Switches that comprise the Base Area Network will require permanent space for the support of its infrastructure and equipment. The ideal space for a typical MDF will be near the site building's existing main point of entry (MPOE) for telecommunications infrastructure. The ideal space for a typical IDF will be within 55 – 60 meter radius of the seats/users to be served.

Site Size in Seats	SF-IDF	Racks- Unclassified	Racks- Classified
Up to 48	8sf/can be wall mounted	1	1
49 – 100	8sf	1	1
101-200	16sf	2	2

01.5.2 The typical MDF will include 3 racks (2 racks for distribution switches – 1 rack for patch panels). The MDF will require a 24 sf footprint.



## 01.6 Ceiling Height Baselines

01.6.1 A typical Server Farm will have the following elevation requirements in order to properly support its functions and must, at a minimum have the following criteria met in order to be accepted as an available candidate:

Raised Flooring Height	Rack / Cabinet Height	Sprinkler Clearance	Lighting Clearance	Overhead Utility Distribution	Total Slab to Understructure Clearance Required
18" – 24"	84"	18"	12"	12"	<b>150" or 12 ½'</b>

## 01.7 Utility Power Baselines

01.7.1 Servers Farms will have high-density equipment installed in high concentration rows and will require extensive utility power, which include all air conditioners, Uninterruptible Power Supplies and lighting. The government is responsible for providing the primary power to the facility; and the ISF will install the power distribution within the ISF facility as needed. Following are the minimum dedicated baseline requirements for the utility criteria in site selection:

Server Farm Size	Primary Voltage	Secondary Voltage	Utility Full Load Amperage
Small – 1,850 s.f	480, 4160, or 12.5	480	380
Medium – 3,000 s.f.	480, 4160, or 12.5	480	634
Large – 4,850 s.f.	480, 4160, or 12.5	480	1200
Very Large – 7,250 s.f.	480, 4160, or 12.5	480	1740

POP Size	Primary Voltage	Secondary Voltage	Utility Full Load Amperage
Up to 48	120	120	40
49 – 100	120	120	60
101-200	480	120/208	100
201 – 1000	480, 4160, or 12.5	480	180
1000 +	480, 4160, or 12.5	480	250

IDF/MDF	Primary Voltage	Secondary Voltage	Utility Full Load Amperage
IDF Cabinet	120	120	40
MDF Cabinet	208	208	40

01.7.2 Consideration must be taken into account on whether or not your local PWO / NAVFAC organization can provide this utility service within the time frame necessary to support the facility build out and completion time frames. A baseline requirement is that the utility power must be made available to the ISF Facilities Design / Build Teams within 75% of the projects completion duration. Typical Project Time Frames from Site Survey to Project Complete are as follows:

Server Farm Size	Duration in Days
Small – 1,850 s.f	119
Medium – 3,000 s.f.	139
Large – 4,850 s.f.	173
Very Large – 7,250 s.f.	216



## **01.8     Standby Generator Baselines**

01.8.1 If not currently present, each and every Server Farm will have an ISF provided, locally approved and compliant standby generator(s) to ensure that an N+1 utility support is provided. In order to comply with this requirement, the GFF site selection must ensure that the following minimums are met:

01.8.1.1 A location for the standby generator(s) is within close proximity to the Server Farm

01.8.1.2 The local Authorities Having Jurisdiction (AHJ) will allow a standby generator to be installed. These jurisdictions may include, but not be limited to the following:

01.8.1.2.1 Regional Air Quality Management

01.8.1.2.2 District Regional / Local Noise Attenuation

01.8.1.2.3 Restrictions Local / Regional Fire Marshals / Base

01.8.1.2.4 PWO Local /Regional Coastal Commissions

01.8.2 Fueling and refueling can be accessed by mid to large size trucks. Soil conditions are adequate for the ISF Facilities teams to design and install the generator pads sufficient enough to support the weights.

01.8.3 Typical Standby Generator Pad sizes are as follows, in which physical space must be made available to the ISF construction team:

<b>Server Farm Size</b>	<b>Pad Square Feet (includes Clearances)</b>
Small – 1,850 s.f	450
Medium – 3,000 s.f.	450
Large – 4,850 s.f.	550
Very Large – 7,250 s.f.	1100

## **01.9     Fire Suppression / Life Safety Baselines**

01.9.1 Where not already present, the ISF Facilities Design / Build team(s) will be installing or retrofitting the sprinkler system to a “pre-action / dry pipe sprinkler system and a gaseous fire suppression system such as the replacement agent to Halon 1301, called FM-200 will be installed as well. These systems will be designed and installed to the National Fire Protect Act 75 as well as comply with most of the NAVFAC requirements to ensure an overall system is installed that meets commercially acceptable standards.

01.9.2 As a part of the GFF site assessment, a determination needs to be made that the building either already has a sprinkler riser in the building, or a connection can be made within close proximity.

## **01.10 Air Conditioning Baselines**

01.10.1 In order for the ISF design / build team(s) to ensure that proper cooling is present, or needs to be enhanced, space needs to be allocated for heat rejection. The heat reject units are air-cooled (dx) type condenser units and need space allocated for placement. Following are the minimum dedicated space criteria in site selection:

<b>Server Farm Size</b>	<b>Pad Square Feet (includes Clearances)</b>
Small – 1,850 s.f	500
Medium – 3,000 s.f.	600
Large – 4,850 s.f.	700
Very Large – 7,250 s.f.	1000

01.10.2 The placement of these condenser units can be either on grade, or roof mounted depending on the structural capacities of the roof structure itself.

01.10.3 Following are the minimum pounds / square foot loading requirements if there is no grade location available and the condensers must be roof mounted:

<b>Server Farm Size</b>	<b>Roof Structure – Pounds / Square Foot</b>
Small – 1,850 s.f	35
Medium – 3,000 s.f.	40
Large – 4,850 s.f.	45
Very Large – 7,250 s.f.	50

## **01.11 Uniform Federal Accessibility Standards (UFAS)**

01.11.1 ISF will comply with all UFAS standards and will incorporate the American Disabilities Act (ADA) in its designs. It is crucial that the sites being considered for GFF site selection be able to meet at a minimum those requirements.

## **01.12 Site Access**

01.12.1 Site access and construction activities, as well as normal post construction operations will require semi-truck deliveries and contractor lay down areas. It will be necessary to provide road and transport access that at a minimum is able to accommodate this vehicular and personnel traffic.

## **01.13 Site Issues – Significant Challenges to be avoided - Baselines**

01.13.1 Asbestos or any other hazardous materials

Because of the nature of asbestos, or any other significant environmental concerns that require government abatement, a site in which the aforementioned is present should be chosen with extreme caution. Since it is the responsibility of the government to provide the ISF with a hazardous material free environment, time and cost to remove must be considered.

01.13.2 Relocation of existing personnel or assets

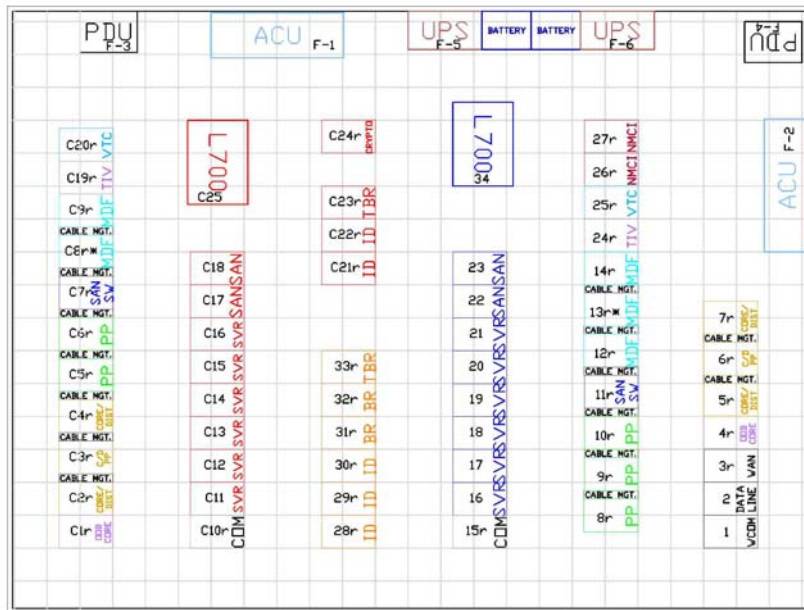
Careful consideration in the cost and time to relocate either existing computing hardware, or existing personnel if the chosen site has such existing, should be taken with caution. Any asset or personnel that resides in a chosen site MUST be relocated prior to the ISF design / build team(s) start date in order to meet their timelines.

01.13.3 Significant command, PWO or organizational approvals

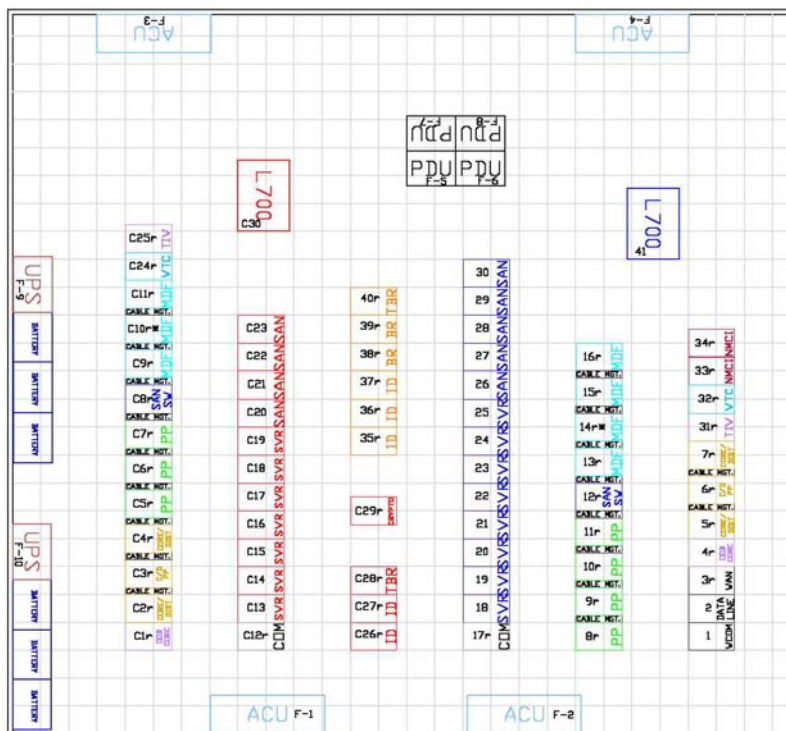
If the site selected poses significant hurdles to seek and receive approval from multiple entities in which the ISF Facilities team can gain approval from which to start construction, then a clear path of process and approval needs to be articulated and proven to be viable.

## 01.14 Typical Baseline Server Farm Floorplans

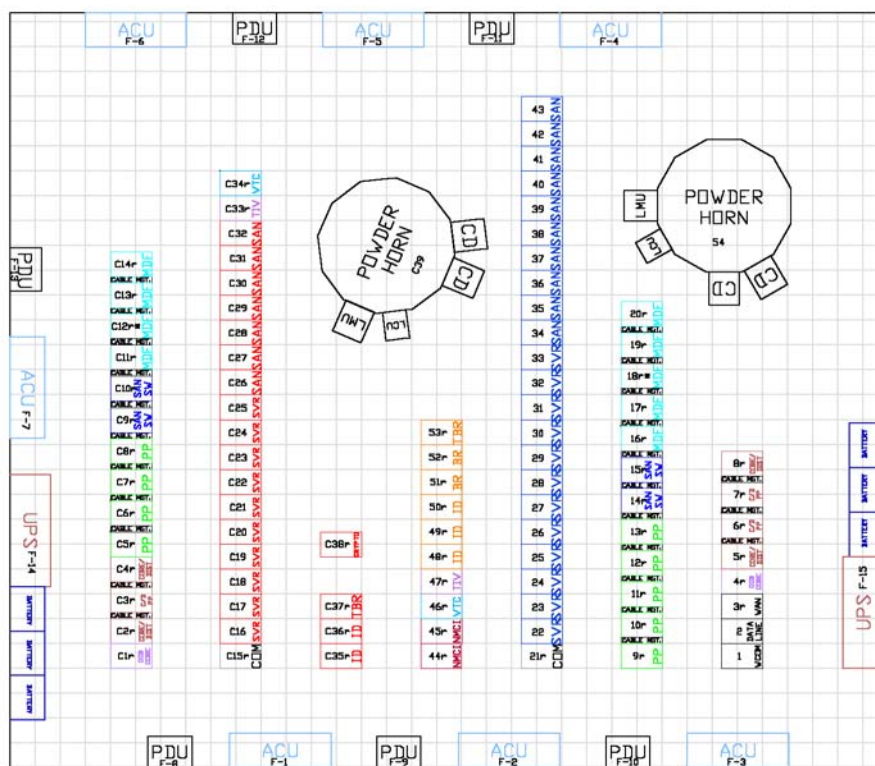
#### 01.14.1 Small (1,850 square feet)



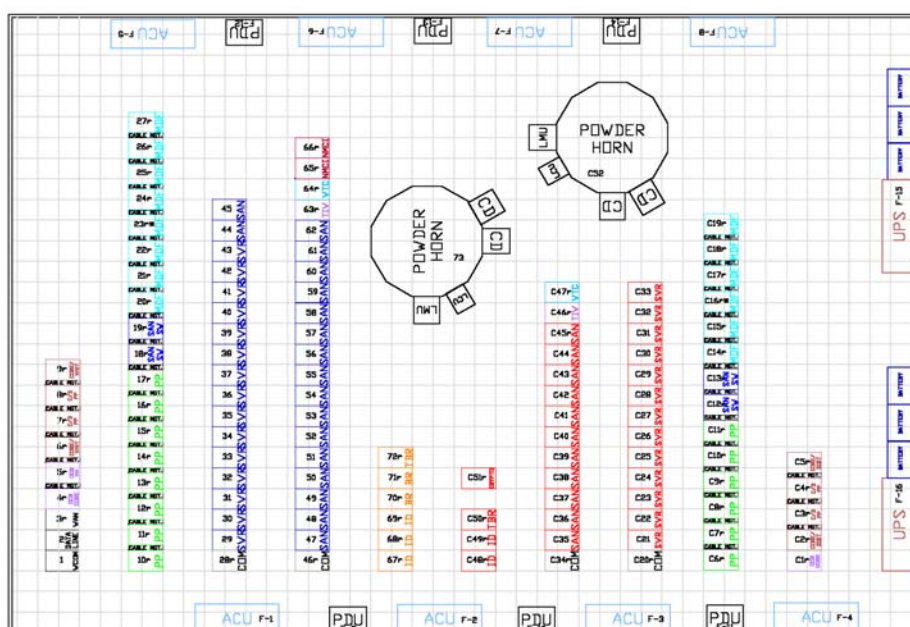
### 01.14.2 Medium (3,000 square feet)



### 01.14.3 Large (4,850 square Feet)



#### 01.14.4 Very Large (7,250 square feet)



## **02      SECTION B      BUILDING GUIDELINES**

### **General Building Guidelines**

#### **02.1      Compliance with Regulations:**

02.1.1 It is the intent that the project, when completed, shall be in compliance with the following codes which are in force at the beginning of the project: Uniform Building Code (UBC); Uniform Plumbing Code (UPC); Uniform Mechanical Code (UMC); Uniform Fire Code (UFC); National Electrical Code (NEC); Occupational Safety and Health Act (OSHA); Americans with Disabilities Act (ADA) as interpreted by California Access Code Title 24; National Fire Protection Association (NFPA) including but not restricted to: NFPA 70B-Electrical Equipment Maintenance, NFPA 70E-Electrical Safety Requirements for Employee Workplaces, NFPA 101-Life Safety Code.

02.1.1.1 If the state in which the project is located has adopted the referenced Code(s) with more stringent requirements, then the State adopted version shall be the governing document. (For Example, the 1997 California Electrical Code supersedes the 1996 National Electrical Code, and is the applicable Code in effect until the next Code Cycle adoption (Expected in 2002).)

02.1.2 In addition to the codes, the applicable provisions of the following national commercial standards which are in force at the beginning of the project shall be referenced as a part of the appropriate section of the work: American Society of Testing Materials (ASTM); American National Standards Institute (ANSI); Underwriters Laboratories Inc. (UL), U.S. Environmental Protection Agency (E.P.A.); Institute of Electrical and Electronic Engineers (IEEE) including but not restricted to: IEEE Standard 1100-Powering and Grounding Sensitive Electronic Equipment (Emerald Book), IEEE Standard 142-Grounding of Industrial and Commercial Power Systems (Green Book), IEEE Standard 446-Emergency and Standby Power (Orange Book); National Board of Fire Underwriters (NBFU); Electronic Industries Alliance (EIA); Telecommunications Industry Association (TIA).

02.1.3 In addition to the codes and national commercial standards, the following commercial trade standards applicable provisions shall be referenced as a part of the appropriate section of the work: Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE); American Society of Heating and Ventilating Engineers guide (ASHVRE); Standard Specification of American Welding Society (AWS); American Concrete Institute (ACI); Concrete Reinforcing Steel Institute (CRSI), American Institute of Steel Construction, Inc. (AISC); National Electrical Contractor's Association (NECA); Standards of Installation, Sheet Metal and Air Conditioning Contractor's National Association (SMACNA); Steel Door Institute (SDI); STC Ratings, Tile Council of America (TCA); Builders Hardware Manufacturer's Association (BHMA); Door Hardware Institute (DHI); Architectural Woodwork Institute (AWI); Building Industry Consulting Services International (BICSI); Illuminating Engineering Society of North America (IESNA); Cal-Trans specifications.

02.1.4 The following security compliance shall be required as a part of the appropriate section of the work: National Industrial Security Program Operating Manual (NISPOM), DoD Directive 5220.22, SECNAVINST 5510.36 DON Information Security Program Requirements, and Contract DD254 apply. TBD DoD and Navy Requirements may also apply.

#### **02.2      Demolition**

02.2.1 All hazardous materials shall be removed by the government prior to entering the site.

02.2.2 All existing items in the way of performing the work shall be removed. Items to be kept by the government shall be stored in an area designated by them.

02.2.3 Provide openings, cutting, coring, and patching of openings in existing building construction as required. Patching shall include openings and voids left in existing construction as a result of demolition.



02.2.4 Cutting shall not impair structural stability of building construction and systems. Drilling holes or welding attachments to beams and other structural members shall only be done after structural review. Fire ratings shall be maintained.

02.2.5 Patching materials shall match existing materials in type and quality. Patching shall be done in a manner to match appearance of adjacent surfaces.

### **02.3 Earthwork**

02.3.1 All earthwork including excavating, trenching, filling, compacting, rough grading, and the like for utilities, building, landscaping and the like shall conform to the following:

02.3.2 Fill shall be placed in lifts not to exceed 8" loose depth when using heavy equipment compactors and 4" when using hand operated mechanical compactors.

02.3.3 Unless otherwise determined by a soils engineer, fill shall be compacted to 95% of the standard Proctor maximum dry density beneath building areas and 90% in paving areas as determined by ASTM D698 Test Procedure.

02.3.4 Brace and shore sides of building and trench excavations as required by OSHA and applicable state safety regulations.

### **02.4 Asphalt Concrete Paving**

02.4.1 Paving sections shall be designed using the most appropriate Cal-Trans Traffic Index given the intended use, and shall be prepared in accordance with Cal-Trans specifications.

02.4.2 Paving marking paint shall be chlorinated rubber, alkyd base.

### **02.5 Concrete Curbs**

02.5.1 Concrete curbs shall be constructed to meet local state and county highway standards.

### **02.6 Traffic Protection**

02.6.1 Bollards and / or guardrails shall be installed at exterior equipment subject to damage in vehicular ways or parking areas.

02.6.2 Bollards shall be concrete filled 6" diameter primed and painted steel pipe columns with a minimum footing depth of 4'. The footing shall be minimum 12" diameter cast-in-place concrete with a compressive strength of 2,000 psi.

02.6.3 Traffic guardrails shall be installed in accordance with Cal-Trans specifications.

### **02.7 Equipment Screen Walls**

02.7.1 Screen walls or fences shall be provided for: Condensers mounted at grade; Standby generators; Rooftop equipment areas that currently have a precedent set for screening such equipment or in aesthetically sensitive areas.

02.7.2 Chain-link fence with vinyl slats shall be used where aesthetics is not an overriding concern. Solid wall construction that matches the design of the building exterior will be utilized where aesthetics is an overriding concern.

### **02.8 Cast-in-Place Concrete**

02.8.1 Concrete reinforcing shall be designed to meet the requirements of the Uniform Building Code, State and local codes and conform to the current edition of the following referenced standards: American Concrete Institute (ACI) *Standard Specifications for Structural Concrete Buildings – ACI 301-72*; *ACI Manual Standard Practice for Detailing Reinforced Concrete Structures – ACI 315-74*; Concrete Reinforcing Steel Institute (CRSI) *Manual of Standard Practice MSP-1*; American Society for Testing and Materials (ASTM) *Specification for Welded Steel Wire Fabric for Concrete Reinforcement ASTM A 185-73*; ASTM

*Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; American Welding Society (AWS) Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction – AWS D 12.1.*

02.8.2 Cast-in-place concrete shall conform to the following standards: American Concrete Institute Specifications for Structural Concrete Buildings – ACI 301; American Concrete Institute Building Code – ACI 318; ASTM Specifications for Ready-Mixed Concrete – ASTM C94; ASTM Specification for Air Entraining Admixtures for Concrete – ASTM C260; ASTM Specification for Chemical Admixtures for Concrete – ASTM C494

## **02.9 Cabinet Work**

02.9.1 Millwork will conform to the Architectural Woodwork Institute (AWI) Manual for “Custom Quality”. Millwork shall be constructed in “Flush Overlay” Style with concealed hinges. All exposed faces shall be finished in plastic laminate. All interior and concealed faces shall be melamine finish.

## **02.10 Doors and Frames:**

02.10.1 All doors shall have metal frames rated grade II by the Steel Door Institute (SDI). Metal frames shall be 16 gage (interior frames up to 4'-0" wide) and 14 gage (exterior frames and interior frames over 4'-0" wide). Metal frames in fire-rated walls shall have fire ratings as required for the wall construction and come with the appropriate Underwriter's Laboratory label. All frames shall be prepared for specified hardware in accordance with the requirements of the Door Hardware Institute (DHI). Frames shall be factory primed for finished painting on the job.

02.10.2 Metal doors shall be 1 ¾ inch thick and have 18 gage face sheets (interior doors) and 16 gage (exterior doors). Metal doors in fire-rated walls shall have fire ratings as required for the wall construction and come with the appropriate Underwriter's Laboratory label. Metal doors shall be a minimum size of 3 ft.-0 in. (92cm) wide x 7 ft.-0 in. (2.1m) high. All metal doors shall be prepared for specified hardware in accordance with the requirements of the Door Hardware Institute (DHI). Doors shall be factory primed for finished painting on the job.

02.10.3 Doors to mechanical and electrical equipment rooms shall be metal, in pairs to form a nominal opening of 8 ft.-0 in. (2.4m) wide x 10 ft.-0 in. (3.0m) high. Doors to computer equipment rooms (where equipment is to be brought into the room) shall be metal, in pairs to form a nominal opening s of 8'-0" (2.44m) wide x 10 ft.-0 in. (3.0m) high.

02.10.4 Exterior doors shall be metal with insulated core of foam polyurethane. Exterior doors in northern climates shall be constructed with a thermal break.

02.10.5 Plastic laminate faced doors shall be 1 ¾ inch thick solid core wood doors with hardwood or plastic faced edges. Interior doors in general office areas shall be laminated plastic faced. Plastic laminate faced doors shall be a minimum size of 3 ft.-0 in. (92cm) wide x 7 ft.-0 in. (2.1m) high.



## **02.11    Hardware**

02.11.1 Hardware shall be provided for each door and shall meet the requirements of the National Industrial Security Program Operating Manual (NISPOM), DoD Directive 5220.22, SECNAVINST 5510.36 DON Information Security Program Requirements, and Contract DD254 apply. TBD DoD and Navy Requirements may also apply. Hardware shall also meet the requirements of the Americans with Disabilities Act (ADA), American National Standards Institute (ANSI), National Fire Protection Administration (NFPA), Builders Hardware Manufacturer's Association (BHMA), Door Hardware Institute (DHI). Fire rated door hardware shall be Underwriter's Laboratories (UL) labeled.

02.11.2 lock and latch sets and shall be manufacturer's standard mortise type, commercial quality in a finish to match existing hardware. All lock and cylinders shall be keyed, and master-keyed. Two keys shall be provided for each lock, six keys for each master-keyed set.

02.11.3 Electric strikes or electric locks shall be provided on doors with card key (controlled) access. Doors providing access to the computer and computer-related facility shall have controlled access provided by a proximity reader card key access system. The access system shall have remote access control and access status printout.

02.11.4 A minimum of three ball bearing, heavy duty hinges shall be provided for doors up to 90" in height, plus one additional hinge for each additional 30". All exterior hinges shall be stainless steel. Heavy duty burglar-proof hinges shall be used at exterior out-swinging doors, and at all interior lockable out-swinging doors.

02.11.5 Closers that are adjustable for ADA opening force requirements shall be installed on doors requiring closers. Panic devices installed in accordance with NFPA 1.1 shall be installed on doors requiring these devices. Exterior doors shall have weather-stripping, thresholds, and floor sweeps. Drop-seals, astragals, closers and smoke seals shall be installed at all doors penetrating the walls enveloping rooms with gaseous fire suppression. Wall bumpers shall be provided wherever possible.

## **02.12    Walls**

02.12.1 New walls and partitions shall be constructed of punched steel studs, hot-dip galvanized, spaced at 16 inches on center. Studs shall be sized to meet Uniform Building Code (UBC) span requirements and meet or exceed minimum requirements. Accessories shall be provided as required for a complete and proper installation, and as recommended by manufacturer of steel studs used.

02.12.2 Construction: New walls shall be constructed with one layer of 5/8 inch gypsum wallboard complying with Uniform Building Code (UBC) in 48" widths and in such lengths as will result in a minimum of joints. Gypsum board systems shall comply with ANSI A97.1. The following types of wallboard shall be used:

- 02.12.2.1    Regular wallboard: type III, grade R, class 1.
- 02.12.2.2    Fire-retardant wallboard: type III, grade X, class 1.
- 02.12.2.3    Water-resistant wallboard: type VII, grade W or X, class 2.
- 02.12.2.4    Foil-backed wallboard: where required.

02.12.3 Metal trim: zinc-coated steel not lighter than 26 gage, complying with Uniform Building Code (UBC). Casing beads: channel-shapes with an exposed wing, and covered with paper cemented to metal, suitable for joint treatment.

02.12.4 Jointing system: shall be installed including reinforcing tape and compound, designed as a system as recommended by manufacturer.

02.12.5 Fastening devices: gypsum wallboard shall be fastened in place on metal studs and metal channels, using flat head screws, shouldered, specially designed for use with power-driven tools, not less than 1" long, with self-tapping threads and self-drilling points.

02.12.6 New walls separating mechanical and electrical equipment rooms shall extend from the floor slab to the bottom of the roof or floor deck above. Two hour rated firewalls shall be installed separating electrical and mechanical equipment rooms where required by code.

02.12.7 Walls surrounding the critical equipment data center areas shall extend from the floor slab to the bottom of the roof or floor deck above and be constructed with a 1-hour fire rated assembly. Sufficient wall insulation shall be installed to ensure that the dew point occurs inside a sealed, dry medium to prevent condensation from forming inside the critical room. Walls surrounding magnetic tape and other media storage shall extend from the floor slab to the deck above and be constructed with a 2-hour fire rated assembly.

02.12.8 All penetrations through fire rated walls shall be fire-stopped in accordance with Uniform Building Code (UBC) section 709.6 709.7. See section 9.2 Penetrations on the following pages of this document.

02.12.9 All gypsum board walls and column enclosures shall have a vinyl or rubber covered base, including the walls within raised access computer floor areas. All gypsum board walls and column enclosures within raised access computer floor areas shall be caulked at the bottom where the gypsum board meets the concrete sub floor. In general, caulking shall be installed at all locations where dissimilar materials meet.

02.12.10 Walls or partitions requiring sound attenuation shall have acoustical batt or blanket insulation installed between the studs. The perimeter and penetrations shall be sealed with an acoustical caulking.

02.12.11 Walls required for new toilet rooms shall be finished with thin-set ceramic tile to 4'-0" above finished floor.

## **02.13 Penetrations**

02.13.1 New and existing raceways, cable trays, and cables for power, data, and communications systems penetrating non-rated and fire-rated floors, walls, and other partitions of building construction shall be fire-stopped where they penetrate new or existing building construction. Fire-stopping shall be accomplished by using a combination of materials and devices, including penetrating raceway, cable tray, or cables, required to make up complete fire-stop.

02.13.2 Existing raceways, cable trays, and cabling that penetrate existing building construction shall be fire-stopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.

02.13.3 Assemblies consisting of individual steel hat type restricting collars filled with intumescent type materials that completely surround communications penetration shall be used for nonmetallic raceways and cabling. Appropriate type or types of through penetration fire-stop devices or systems shall be used, appropriate for each type of communications penetration.

02.13.4 Selected systems shall not be rated less than the fire-ratings for each respective fire-rated floor, wall, or other partition of building construction and shall meet the requirements of the Uniform Building Code (UBC) section 709.6 709.7. Fire-stop for each type communications penetration shall conform to requirements of Underwriters Laboratory (UL) or an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.

02.13.5 In "finished" areas, fire-stop systems shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.

02.13.6 Damming materials, plates, wires, restricting collars, and devices necessary for proper installation of fire stopping shall be provided. Materials that have no irritating or objectionable odors shall be used when fire-stopping is required in occupied areas.

02.13.7 All fire-stops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.

02.13.8 If required by inspecting authorities, fire-stopping shall be exposed and removed to the extent directed then restored where removed for inspection.

## **02.14 Floors**

02.14.1 All existing concrete floors shall be sealed with a non-penetrating sealer, which is a moisture barrier and prevents dusting/particulation. All concrete floors under raised floor systems and in mechanical and electrical equipment rooms, battery rooms, dock areas, etc. shall be exposed sealed concrete.

02.14.2 All new office areas shall be carpeted with commercial quality carpet tile.

02.14.3 Where toilets are required to be added in the building to serve the facility, new toilet room floors shall be finished with non-skid, thin-set ceramic tile complying with ANSI A137.1 and meeting the requirements of the Tile Council of America (TCA).

## **02.15 Ceilings**

02.15.1 All areas, with the exception of mechanical and electrical equipment rooms, shall have a 2 ft. x 4 ft. (60cm x 1.2m) suspended lay-in acoustical ceiling panel system. Ceilings shall be a complete system of supporting members, anchors, wall cornices, adapters for light fixtures and grilles, and accessories of every type required for a complete suspended "T" grid system complying with requirements of Underwriters Laboratories, Inc (UL). Lateral bracing secured to structural members shall be provided as required by codes and regulations. Panels (Flame spread rating of 25 or less):

02.15.1.1 Ceiling system type 1: "Vinyl coated" non-perforated, 24"x48"x5/8";

02.15.1.2 Ceiling system type 2: "Fire Guard", fissured, 24"x48"x5/8".

02.15.1.3 Ceiling system type 3: As required.

02.15.2 As an alternative to the ceilings listed above, an exposed-construction, or 'no ceiling' scenario shall be considered. This will be a site-specific decision based on aesthetic, fire protection, cost or cleanliness requirements. If this alternative is selected, then the exposed-construction shall be painted and the appropriate lighting, fire detection and fire suppression systems installed. If the structure above the raised floor area is structural steel with a sprayed-on fireproofing material, then a suspended ceiling shall be installed.

02.15.3 For areas containing a suspended ceiling system, the ceiling height in data center areas shall be 12 ft.-0 in. (3.7m) above finished floor. The clear height in equipment rooms between the floor and bottom of the exposed structure shall not be less than 15 ft.-0 in. (4.6m). The distance between the top of any equipment or racks, and the ceiling shall be a minimum of 18 in. (45cm).

02.15.4 All General Office areas shall have 2 ft. x 4 ft. (60cm x 1.2m) standard suspended lay-in acoustical ceiling systems. The ceiling height shall be 10 ft.-0 in. (3.0m). All equipment rooms shall have painted exposed-construction ceiling areas.

## **02.16 Painting**

02.16.1 All new walls and partitions, door frames, and other new items requiring painting shall be painted. All existing walls that remain and exposed ceiling-less construction shall be painted.

02.16.2 The following surfaces shall not to be painted: aluminum, stainless steel, concrete, hardware, pre-manufactured cabinets.

02.16.3 All colors shall be selected prior to beginning work. Materials shall be first line products. Primers shall be used where a prime coat does not occur or where touch-up is necessary to cover bare surfaces. All surfaces to be painted shall be cleaned free of loose dirt and dust before painting is started.

02.16.4 All new gypsum board walls and shall be primed then painted with two coats as recommended by the paint manufacturer. The final paint coat shall provide a satin, semi-gloss finish. All scratches, abrasions or other defacements in gypsum board surfaces shall be repaired and filled. Filling shall be sanded smooth and

sealed before application of priming coat. Existing surfaces shall be prepared by removing loose, blistered or otherwise defective paint and varnish and smoothing edges with sandpaper.

02.16.5 Paint shall be applied with brush or roller, unless otherwise approved. Spray application of materials using approved type airless equipment may be acceptable with written permission.

02.16.6 Final coat on interior work shall not be applied until other trades are finished with their work, based on a normal sequence, and all their materials and debris removed and the premises left in a substantially clean condition.

02.16.7 Just prior to final completion and acceptance, all painted and finished surfaces shall be examined and retouched or refinished as necessary and required to leave all surfaces in good condition.

## **02.17 Raised Access Computer Floor Systems**

02.17.1 All raised floor installations shall comply with local seismic codes for bracing. The space under the flooring should be used to install cable to the equipment racks. This space can also be used as a return air plenum when applicable. All cabling used in this space must be "plenum rated" for low emission of combustion by-products. Any combustibles placed under the floor must be protected by fire suppression sensors and release nozzles that are located beneath the floor. Where access flooring is used in seismic zones, the support system shall be braced with seismic ties as recommended by local codes and by methods that are standard with the flooring manufacturer. Epoxy pedestal adhesive may be used except at seismic anchor locations which require attachment by wedge anchors.

02.17.2 Raised access computer floor systems shall be a nominal 24 in. x 24 in. (60cm x 60cm) steel panel. The floor shall be 24 in. (60cm) high unless determined otherwise. The floor understructure shall be a rigid-grid basket weave bolted system.

02.17.3 The panels shall be: 1200 pound, 22 gauge, hot-dipped galvanized steel, high-density steel panel, completely encased; 1" thick, with 48 pound core; finished with 1/16" high-pressure laminate. The surface electrical resistance shall be between 5.0 and 2.0 ohms.

02.17.4 Perforated air panels shall be flush to match surrounding floor panels; shall have 139 sq. in. of open area per panel via the use of 5/16" holes; shall be entirely of hot-dipped galvanized steel, except for the covering material and trim edge. Generally, one perforated panel per one ton of air conditioning shall be provided, or approximately one perforated panel for every 75 ft<sup>2</sup> (7 m<sup>2</sup>) of raised floor area.

02.17.5 The system shall support rolling loads over the entire floor area of 600 lbs. (272 kg.). Panels shall support a concentrated load of 1,200 lbs. (544 kg.) on one square inch in the center of the floor panel surface, with a maximum deflection of .08 in. The system shall support a uniform live load of 150 lbs/ft<sup>2</sup>, with a maximum deflection of .04 in. Perforated panels shall support a concentrated load of 800 lbs. (363 kg.) on one square inch in the center of the floor panel surface, with a maximum deflection of .08 in. The perforated panel system shall support a uniform live load of 150 lbs/ft<sup>2</sup>, with a maximum deflection of .04 in. Stringers shall support a load of 450 lbs. (204 kg.) applied at the center of a span with no more than .01 in. permanent deflection.

02.17.6 Pedestals shall be secured to the floor with manufacturer's standard adhesive or seismic anchors where required. Rigid grid framing shall be not less than 15 gage galvanized steel. The grid shall be screwed to the pedestal caps. Grids shall be attached in a basketweave type pattern with the nominal 48 inch grids perpendicular to nominal 48 inch grids. The top of the grid shall be covered with electrically conductive, sound dampening, gasket strips.

02.17.7 Areas that are dedicated as rolling load pathways shall have concrete panels rated for the required loads. Rolling load pathways shall be identified by the use of an alternate color for the panels. Perforated panels and regular panels shall not be used in these pathways.

02.17.8 Lifters shall be provided, one lifter for every 1000 square feet and bracket adjacent to every fire extinguisher location.

02.17.9 Ramps, steps and aluminum railings shall be provided where required, installed in compliance with the American Disabilities Act (in the US), and according to all local regulations.

**02.18 Signage**

02.18.1 All interior and exterior signage required will be contracted separately and shall not be a part of the construction project.

## **03      Mechanical Building Guidelines**

### **03.1      Fire Protection and Fire Detection**

#### **Automatic Flooding System:**

03.1.1 The facility shall be protected by fire detection and suppression systems meeting the requirements of the National Fire Protection Association (NFPA) pamphlets 13, 72 and 2001. This shall be a double-interlock, pre-action, dry pipe sprinkler and a FM-200 or Inergen gaseous system in critical equipment areas. Rooms that are not housing mission critical equipment shall be protected with a standard automatic water based fire suppression systems.

03.1.2 Equipment room areas, electrical equipment rooms, battery rooms, and tape or record storage rooms, shall be provided with total flooding gaseous agent extinguishing systems and a double interlock, dry pipe, pre-action sprinkler system, utilizing galvanized schedule 40 pipe, with cross-zoned heat detection on the ceiling. This configuration allows for the sprinkler piping to remain dry until the heat detection activates, plus at least one sprinkler head fuses (two events before water flows). Once activated the pre-action valve shall open permitting water to fill the sprinkler pipes.

03.1.3 Water shall not flow from the sprinkler heads until ceiling temperatures are high enough to cause the individual fusible link within the sprinkler to operate. This arrangement minimizes the risk of accidental water damage. These pre-action systems shall have supervised air pressure (low-pressure alarm) maintained on the system piping. Pressures shall be maintained per manufacturer's specification with 20 to 30-psi used as guidelines.

03.1.4 Automatic smoke detection equipment shall be installed in all areas including sub-floor areas and on ceilings (attic spaces assumed to be non-combustible, requiring no fire protection). The intent is to provide an early warning of fire, heat or existence of products of combustion before a substantial portion of electronic equipment is damaged or destroyed. This system shall also be utilized as a life safety tool to notify building personnel of fire related emergencies and the necessity for evacuation of the building.

03.1.5 The system shall be an intelligent reporting, microprocessor controlled fire detection system installed in accordance with the manufacturers specifications and local jurisdictional regulations. All alarms and trouble signals shall be transmitted from the protected premises to a continuously attended supervising station facility. The fire alarm system shall monitor any abnormal conditions within the system, all smoke detection devices, air sampling systems, sprinkler system water flow and supervisory switches, fire pumps (if installed) and manual pull stations. The fire alarm system shall automatically operate alarm notification appliances, release mechanisms for all fire suppression systems, automatic door closures, and where necessary, automatic HVAC shutdown. The fire alarm system shall have provisions for automatic Emergency Power Off (EPO) activation based on site specific criteria.

#### **Hand-held Fire Extinguishers:**

03.1.6 Wall mounted NFPA Type 2A:10BC rated fire extinguishers shall be installed in electrical equipment areas so that travel distance to a fire extinguisher shall not exceed 75-ft. (23m) or 6000 square feet. General Office areas and common areas shall have an NFPA 2A rated extinguisher.

### **03.2      Plumbing**

03.2.1 Plumbing systems to support the floor-mounted air handlers or air conditioning units shall consist of a reverse osmosis water system and condensate drainage. A connection shall be made to the building domestic cold water system through a reduced pressure backflow preventer. This system shall include drainage provisions for the reduced pressure backflow preventer.

03.2.2 The reverse osmosis water system shall be routed to each of the floor-mounted air handlers or air conditioners for humidifier operation.



03.2.3 The condensate from the floor-mounted units shall be routed to an approved discharge point such as a floor sink. All floor sinks shall be provided with trap primers.

03.2.4 Condensate lines in the ceiling space and below raised floors shall be insulated to preclude condensation. All water piping and condensate piping in the ceiling space shall have a sheet metal trough installed below the piping. The sheet metal trough shall be sloped to a point where a 3/4" drain line can be day-lighted thru a corridor ceiling.

### **03.3 Heating, Ventilating, Air Conditioning**

03.3.1 Multiple stand-alone computer room A/C units, with roof or grade mounted DX condensers shall be installed for the raised floor areas. This will allow for maintenance on individual units without affecting the data center environment.

03.3.2 Each A/C unit shall be equipped with microprocessor controls, monitoring and alarms, dry contacts for remote monitoring, non-locking disconnects, dual step-load compressors, humidity control, water detection and a tubular steel floor-stand. The DX condensers will be rated for 95-degree ambient air, or designed for the known ambient conditions of the specific site.

03.3.3 All office space, general building, and make-up air to the computer room HVAC, shall be provided by rooftop package units with insulated ductwork distribution systems.

03.3.4 Ventilation of the battery room(s) shall follow the requirements set forth in NEC 480-8 and NFPA 111 Section 5-3.2 (for US installations) and provide a minimum of 2 air changes per hour.

### **03.4 System**

03.4.1 A Liebert Site Scan will be the central monitoring system. All devices shall be wired for and connected to local Liebert devices for transmission to the Facilities Operations Centers. Central Monitoring and Alarm System shall be connected to all electrical and mechanical systems. This system will be monitored on a 24/365 basis from a NMCI ISF-designated remote monitoring station. Alarms automatically issue pages to responsible technicians, and will escalate to management if no timely response is made.

03.4.2 Electrical monitoring capabilities shall include the ability to remotely read meters and receive alarms on Main Power Switchboards, Stand-by Generators Systems, Main Distribution Panels, Uninterruptible Power Supply Systems, Static Transfer Switches and individual Power Distribution Units including remote side-cars (if used).

03.4.3 Mechanical monitoring capabilities shall include individual air conditioning settings, supply-return air temperatures, and unit alarms. Also outdoor, room and under floor temperature/humidity, and selectable battery cell temperatures.

## **04      Electrical Building Guidelines**

### **Electrical System Design**

#### **04.1      General**

04.1.1 Electrical system shall be designed as a complete, coordinated system from the point of connection to utility power to the point of farthest power distribution and shall be complete with all required electrical equipment and materials. Materials used, and installation techniques utilized shall be appropriate to provide highly reliable service for the purpose intended. Refer to Section 01.1 for applicable Codes and Standards.

04.1.2 The electrical design shall result in electrical systems having the maximum “on-line” or “up time” feasible; to be achieved through the use of alternate power sources, and redundant equipment arranged to provide multiple power sources and multiple power paths to mission critical Information Technology equipment.

04.1.2.1 There shall be provisions for maintenance of major items of equipment without interrupting the operation of the Information Technology equipment.

#### **04.1.3 Power Sources**

04.1.3.1 Utility power shall be provided as the basic power supply.

04.1.3.2 One or more diesel engine generator(s) shall be provided to supply Standby power, redundant to the Utility power supply. An Automatic Transfer Switch and associated By-Pass switches shall be provided to allow for the transfer of the electrical distribution system from the utility source to the standby engine generator, and to allow the manual selection of Utility or Standby power to supply the electrical distribution system, without interruption (to allow for the maintenance of the Automatic Transfer Switch).

#### **04.2      Power Distribution**

04.2.1 Electrical system protection shall be a fully selective overcurrent protection system; “Series Rated” systems or “System Rated” components are not acceptable.

04.2.2 A Fault Current analysis shall be performed as the basis of selection of the overcurrent devices and their specific settings, where the device is adjustable. The fault current analysis and the settings for adjustable overcurrent devices shall be submitted for inclusion in the Record Documents and for use by the commissioning personnel.

04.2.3 “Non Technical” power distribution shall be supported by the Utility and the engine generator(s), but not by the Uninterruptible Power Supplies system(s). “Non Technical” Power shall be distributed to mission non-critical loads, including lighting, air conditioning and general purpose power utilization devices.

04.2.4 “Technical” power distribution shall be supported by the Utility and the engine generator(s), conditioned and battery supported via redundant Uninterruptible Power Supplies (UPS), and distributed via external UPS Maintenance By-Pass Switches, UPS output power distribution equipment, Power Distribution Units (PDU’s) and redundant branch circuit wiring terminating in connecting wiring devices (Twistlock receptacles). “Technical “ power shall be distributed to mission critical loads, including Information Technology (IT) equipment, alarm systems, access control devices, life safety alarm devices and other designated mission critical utilization equipment.

04.2.5 Rack mounted Information Technology equipment, with two integral power supplies, shall be supplied with multiple (minimum of two) branch wiring circuits, via conductors in liquidtight flexible conduits, to duplex twistlock outlets (as required to provide appropriate voltage and current) located in the raised floor plenum, adjacent to the equipment served. Each duplex outlet shall be served by a PDU, UPS and associated wiring unrelated to the other duplex outlet, and its supporting PDU and UPS. The net effect will be to have each rack or cabinet supplied from two, independent, unrelated power paths.



04.2.6 Information Technology equipment not mounted in racks shall be supplied with branch wiring circuits, via conductors in liquidtight flexible conduits, to outlets (as required to provide appropriate voltage and current, with configuration as directed by equipment manufacturer) located in the raised floor plenum, adjacent to the equipment served. Each such outlet shall be served by a PDU, UPS and associated wiring.

04.2.7 Information Technology equipment room areas, shall be provided with duplex, general-purpose receptacles brown in color (signifying "Dirty" or unconditioned power). Receptacles shall be provided on perimeter walls at 12' centers, and on any columns within the space, at 18" above the finished raised floor.

04.2.8 Emergency Power Off Controls: An Emergency Power Off (EPO) button shall be located at each point of egress out of the Server Farm. The emergency power off button shall be protected from accidental actuation. When actuated, the EPO shall disconnect power to all of the equipment in the Information Technology equipment room including UPS systems, PDUs, heating ventilating and air conditioning systems, but not including the lighting systems, general purpose power receptacles or the Fire Alarm System.

04.2.9 The Server Farm areas that contain critical computer and communications (Information Technology) equipment shall be designed to support an average equipment load of 85-watts/ft<sup>2</sup>. This equipment load is for the IT equipment only, and does not include the infrastructure such as lighting and air conditioning, which is not supported by "Technical" power supplies.

04.2.10 Power for General Office and Non-Raised Floor Areas shall be designed to support a total load of 10 watts/square foot.

### **04.3 Lighting:**

04.3.1 General: Lighting equipment shall be high efficiency fluorescent, with fixtures providing lamp protection against physical damage. Lighting design, including lighting controls, shall comply with all applicable energy codes.

04.3.2 In areas with a suspended ceiling grid system fixtures shall be recessed. For areas that do not contain a suspended ceiling system, fixtures shall be surface mounted.

04.3.3 In Server Farm raised floor areas, fixtures shall have prismatic acrylic diffusers. Lighting levels for these areas shall be 50-foot candles at 30 in. above the finished raised floor level. The lighting design layout shall line up over the equipment aisles, and not over the equipment. Additional fixtures shall be installed behind equipment aisles as required to maintain the light intensity.

04.3.4 In Office areas and similar support areas, fixtures shall have low brightness diffusers, such as matte parabolic diffusers, or shall be indirect type, similar to Lithonia "Avante" series

04.3.5 In loading dock, mechanical and electrical equipment rooms, and all related equipment support rooms, fixtures shall be 4 foot industrial type fluorescent fixtures. Fixtures shall be surface mounted or suspended as necessary. Lighting levels for these areas shall be 30-foot candles at 30 in. above the floor level.

04.3.6 Emergency lighting and exit signs shall be installed as required by the applicable code. Lighting fixtures with integral battery inverter back-up shall be provided in the Information Technology room, in the vicinity of the main electrical switchgear, in the UPS room, and in the vicinity of the UPS output distribution equipment.

### **04.4 Grounding**

04.4.1 Electrical system grounding will be provided in accordance with the applicable requirements of the National Electrical Code, the recommendations of the IEEE, and the recommendations of the UPS/PDU manufacturer to minimize ground current path potentials and current.

04.4.1.1A Master Ground Bar/Telecommunications Grounding Bar (TGB) shall be provided in each Information Technology room to act as a central connection point.

04.4.1.2A Master Ground Bar/Telecommunications Main Grounding Bar (TMGB) shall be provided in the main electrical equipment room to act as a central connection point and to facilitate the electrical system service ground. The Master ground Bar in the electrical equipment area shall be the point of bonding for structural steel, piping systems and other required bonds.

04.4.1.3An equi-potential plane ground system shall be provided. This ground plane shall consist of the raised floor assembly bonded together by a bonding conductor in the raised floor plenum, routed around the perimeter of the raised floor area and bonded to the raised floor pedestals with bolted lugs. The bonding conductor shall be a minimum #6 AWG copper wire and shall be bonded to the raised floor perimeter pedestals at eight feet (8') on centers; and shall be bonded to the TGB in the raised floor area.

04.4.2 Harmonic currents and their impact upon the electrical distribution system shall be minimized by the proper selection of materials and application thereof.

04.4.3 Line Transient Voltage Surge Suppression (TVSS) shall be incorporated into the electrical distribution system. TVSS devices shall incorporate both Common Mode and Normal Mode suppression, and shall be installed at service equipment switchboard(s).

04.4.4 Where required by local practice, or by Lightning Risk Assessment, Lightning Protection System(s) shall be provided.

04.4.4.1Lightning Risk Assessment shall be performed in accordance with NFPA 780, "Lightning Protection Systems", Appendix H. (Index "A" (Type of Structure) shall be = 8; Index "E" (Occupancy and Contents) shall be = 9.))

04.4.4.2Where required, Underwriters Laboratory (UL) approved lightning protection system shall be provided, consisting of copper wire and roof mounted air terminals around the perimeter of the building as well as at all roof top screen walls and roof top equipment. The system shall be attached to independent ground rods that shall not be bonded to the building grounding system. The lightning protection system shall be installed according to local and national code requirements.

#### **04.5     Testing and Commissioning:**

04.5.1 All major equipment components shall be thoroughly tested at the factory and all equipment and systems shall be fully tested at the facility before being placed into service.

04.5.2 Bank provisions for testing purposes: The Main Switchboard and Generator Switchboard shall be provided with appropriate circuit breakers to facilitate the connection of a temporary, portable load bank to the system for load testing without the need to shutdown critical equipment. The generator and the UPS system shall be able to be taken off-line and tested under full-load conditions by means of the load bank(s). (The load bank is not part of the facility electrical system and will be rented by the testing/commissioning/maintenance organization as needed.

04.5.3 Commissioning of the electrical system shall be performed upon completion of the electrical system installation and inspection thereof. Among the tests to be performed demonstrating the electrical system capabilities will be load testing to assure that each component is capable of providing its rated output.

04.5.4 In addition, upon component testing completion, the Utility power source shall be disconnected to demonstrate that the redundant equipment of the electrical power system, including the engine generator and UPS systems, is capable of assuming and supplying the facility's connected electrical loads.

#### **04.6     Electrical System Materials**

04.6.1 All electrical materials shall be new, shall be the product of (a) manufacturer(s) regularly engaged in the manufacture of the product for a minimum of five years; and shall bear the label of a Nationally Recognized Test Laboratory (NRTL), such as Underwriter's Laboratories (UL), as proof of conformance to applicable Material Standards.

04.6.2 Wire shall be copper ONLY, type THHN/THWN.

04.6.3 All wire shall be installed in raceways.

04.6.3.1 Where feasible, raceway installations shall be concealed in new construction.

04.6.3.2 Exterior feeders between the utility source, transformers, generators and main switchboard shall be underground, where feasible and appropriate.

04.6.3.3 Rigid conduit shall be utilized where the raceway is subject to damage.

04.6.4 A cable tray system (basket tray type) shall be provided for the under- (raised) floor data cable distribution by the data cable installer.

#### **04.7 Diesel Engine Generator(s)**

04.7.1 Provide one or more stand-by diesel engine generator systems to operate the entire facility. Diesel engine generator(s) capacity shall be adequate to support the facility's electrical loads.

04.7.2 Where facility design load exceeds the capacity of a single engine generator set, the electrical loads shall be divided into two or more load blocks. Each load block shall be supported with a diesel engine generator, an automatic transfer switch, bypass switch and appropriate distribution equipment. (This method of achieving power supply redundancy is preferable to the provision of engine generator paralleling switchgear.)

04.7.3 The engine-generator(s) shall consist of diesel powered engine, 3-phase generator, system control panel, cooling system, critical muffler exhaust system, isochronous governors, dual starters, battery and battery chargers, engine block heaters, and a fuel tank (with double wall, and leakage detection monitoring/alarm equipment) to support the calculated load for a 24 hour period.

04.7.3.1 Provide a remote status panel, located in the Server Farm.

04.7.3.2 Additional equipment heaters shall be provided in locales where required to assure proper equipment functioning.

04.7.3.3 Weatherproof enclosure(s) applicable for the site conditions for engine generator sets installed outdoors shall be provided. The enclosures shall meet all sound attenuation requirements of the Authority Having Jurisdiction, if any.

#### **04.8 Automatic Transfer Switches:**

04.8.1 All automatic transfer switches, or separate circuit breakers utilized as an automatic transfer switch, shall have a complete isolation by-pass switch. This by-pass switch shall allow alternate paths and maintainability without a power outage to the source that it feeds.

04.8.2 The automatic transfer switch(es) shall be provided with an "in-phase monitor" to assure that re-transfer to the utility source (following a utility outage and subsequent restoration) can occur only when the on line engine generator power is in phase with the incoming utility power. This "in phase" function shall be the only basis for transfer; no time over ride function is acceptable.

04.8.3 Overlapping automatic transfer switch contacts, so that engine generator is momentarily in parallel with the utility source, is discouraged. If utilized, the automatic transfer switch MUST be submitted to the serving public utility and their written approval obtained prior to use.

#### **04.9 Uninterruptible Power Supply (UPS)**

04.9.1 Each UPS system shall consist of a control cabinet, UPS modules complete with input filters, and batteries (in a static system). Liebert shall be the standard manufacturer

04.9.2 Exterior Maintenance By-Pass switches shall be provided.

04.9.3 Batteries – Cabinet mounted applications: Sealed, flame retardant, valve regulated, low maintenance, lead acid batteries shall be used for the specified UPS system. The batteries shall be housed internal to a UPS matching battery cabinet, and sized to support the UPS at rated load and power factor. No back or side clearance shall be required for the cabinets. The ambient temperature shall be between 68° and 86° F (20° and 30° C), for a minimum of 10 minutes reserve time. Each battery string shall be provided with an independent battery disconnect. The expected life of the batteries shall be 10 years.

04.9.4 Batteries – Rack mounted applications: Sealed, flame retardant, lead calcium batteries shall be used for the large specified UPS system. The batteries shall be housed in freestanding racks that reside in a separate battery room. The batteries sized to support the UPS at rated load and power factor, in an ambient temperature between 68° and 86° (20° and 30° C), for a minimum of 10 minutes reserve time. Each battery string shall be provided with an independent battery disconnect. The expected life of the batteries shall be 20 years.

04.9.5 Battery Racks: Rigid steel racks (for non-cabinet applications) that are designed specifically for the battery cell type shall be furnished. Battery racks must meet all seismic design requirements for the region where installed. The racks shall be two-tier type and shall not extend closer than within 36" of the ceiling. The rack system shall be provided with pre-applied insulation, acid resisting, epoxy paint.

04.9.6 Power Distribution Units (PDU's) shall consist of isolating/step-down "K" rated transformer connected to multiple bolt-on circuit breaker style panelboards in a common cabinet incorporating integral digital monitoring equipment. Primary transformer voltage shall be 480 volts, or as required to match existing utility voltage; secondary voltage shall be 120/208 volts. PDU capacity shall be as required to support calculated loads.

04.9.7 There shall be a minimum of 84 and a maximum of 210 branch circuit spaces. Provide 10% spare circuit breakers and 10% spaces for future circuit breakers, in addition to circuit breakers to serve present branch circuit requirements

## **04.10 Installation Standards**

04.10.1 Installation of materials shall comply with the requirements of the National Electrical Code as adopted by the Authority having Jurisdiction, defined as the State in which the project is located

04.10.2 Installation of materials shall comply with the NECA "Standards of Installation".

04.10.3 Specific installation requirements or recommendations of the material manufacturer shall be complied with.

04.10.4 Electrical contractor is to carefully coordinate the electrical installation to assure that conflicts between the electrical installation and the work of other trades is avoided.

04.10.5 Electrical Contractor is to carefully coordinate location of electrical installations in the raised floor plenum to avoid conflicts with data cable tray installation and other installations, such as fire detection system, water sensors, etc. and to preserve access to the raised floor plenum.

04.10.6 Exterior equipment mounted on grade or on concrete pads shall have the lowest one-inch (1") of the equipment coated with a continuous bituminous material to prevent corrosion.

## **05 Security Systems Guidelines**

### **05.1 Security Systems**

05.1.1 Security Access and Surveillance: The security system shall include a card access system with proximity-access controls and keypads. The system shall allow for status levels zone control, time zones, and audit trails. Locking devices shall be electric strike. The access hardware and control system shall be configured as 'fail-secure' type, such that in the event of a loss of electric power, controls, or signal to the

strike, the door hardware remains locked and secure. The emergency exits are still unhindered in this mode by means of panic bar hardware on the inside of the room.